

Discussion on the White Paper

Existing Docs

- Depth document
- FNAL-BNL Long Baseline report
- hep-ex/0608023v2 ("Proposal for an experimental program...")
- NuSAG Report
- PRD 68 ("Very Long Baseline...")
- hep-ex/0306053 ("Megaton Modular...")
- UNO Proposal
- Hyper-K proposal
- APS neutrino study
- ...

This will not be the first time this idea has been presented

So What's New?

- Beam and detector location now defined
- Depth/detector gives broad program of physics and astrophysics
- Most pre-requisite experiments are funded
- Additional precision on ν mixing parameters

Goals

- Define answers to sensitivity questions—what is needed to do compelling physics?
 - including detector mass
 - detector technology
 - beam intensity
- Inform the community about physics opportunities
- Provide funding agencies with `ammunition' to push program
- Provide touchstone doc. for future proposal development

Q: Should this be intended as part of detector technology decision process?

Push the Breadth

FNAL→DUSEL is an 'extended facility' with which many experiments can be done

- neutrino CP violation
- neutrino matter effect/mass hierarchy
- θ_{13} (with beam)
- $\theta_{12}, \Delta m^2_{12}$ (with beam)
- Proton decay
- $\theta_{23}, \Delta m^2_{23}$ (with beam)
- $\theta_{23}, \Delta m^2_{23}$ (with atmospherics)
- solar day/night
- solar hep ν s
- supernova ν s
- Diffuse supernova ν s
- Exotics (fractional charge, Q-balls...)
- geoneutrinos
- WIMP annihilation in Sun/Earth
- θ_{13} with source/reactor
- near detector physics (xs, exotics)

Sample Outline

High Level Outline:

- I. Status of the field
- II. Opportunity of the site and FNAL
- III. Physics Program
- IV. Beam requirements
- V. Detector Options
- VI. Sample costs and schedule

Contents

1	Open Questions	2	4	Beam Requirements	2
1.1	Neutrino Mixing and CP Violation	2			
1.2	Nucleon Decay	2	5	Detector Options	2
1.3	Geoneutrinos	2	5.1	H ₂ O Cherenkov	2
1.4	Astrophysical ν Sources	2	5.1.1	Estimated Cost and Schedule	2
2	Opportunity of DUSEL and FNAL	2	5.2	Liquid Argon	2
2.1	DUSEL Site	2	5.2.1	Estimated Cost and Schedule	2
2.1.1	Geology	2	5.3	Near Detectors	2
2.1.2	Depth Availability	2	6	Overall Cost and Schedule	2
2.1.3	Timetable	2	6.1	Cavities at Homestake	2
2.2	FNAL Beam	2	6.2	Beam	2
2.2.1	Energy	2	6.3	Near Detector	2
2.2.2	POT	2	6.4	Projected Timeline for Construction and Physics	2
2.2.3	Upgrade Path	2			
3	Physics Program	2			
3.1	Long Baseline Program and the Mixing Matrix	2			
3.1.1	The (2,3) Sector	2			
3.1.2	The (1,2) Sector	2			
3.1.3	The (1,3) Sector	2			
3.1.4	Matter Effect and Mass Hierarchy	2			
3.1.5	Dirac CP Violation	2			
3.1.6	Non-standard Scenarios	2			
3.2	Proton Decay	2			
3.2.1	Expected Sensitivity	2			
3.3	Solar Neutrinos	2			
3.3.1	Day/Night Effect	2			
3.3.2	hep Neutrinos	2			
3.4	Supernova Neutrinos	2			
3.4.1	Event Totals and Distance Sensitivity	2			
3.4.2	Diffuse Supernova Neutrinos	2			
3.5	Geoneutrinos	2			
3.6	Atmospheric Neutrinos	2			
3.6.1	Mixing Measurements	2			
3.6.2	Matter Effect	2			
3.7	Reactor θ_{13} Measurement	2			
3.8	Exotics	2			
3.8.1	WIMP Annihilation in the Earth and Sun	2			
3.8.2	Other Exotica	2			
3.9	Near Detector Physics	2			
3.9.1	Cross Section Measurements	2			
3.9.2	Sterile ν Searches	2			

Open Questions on Scope

Q1: How much site-related detail? (e.g., rock removal...)

Q2: Include a plan for a detector decision, or leave technology open?

Q3: How much beam detail?

Q4: How much detector detail?

Q5: How much technical detail (calibrations, DAQ...)?

Q6: How much engineering detail?

Q7: Do we include a discussion of phases (beam and detectors)

Q8: Do we need to include things like safety, outreach,...?

White Paper Plans and Schedule

- Need a small (3-5 people) `White Paper Editorial Board`
- Will draft more complete outline
- Generate writing/analysis assignments
- Complete doc ready before end of calendar year?